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IN THE LAB

Retracing the Steps of Southern Flounder

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EXCITING TO CATCH and delicious to eat, southern flounder is one of the most highly sought fish on the Gulf Coast. Southern flounder supports a large and important recreational fishery and every year in the late fall and early winter, as adult southern flounder migrate from bays to the Gulf of Mexico to spawn, thousands of fishermen brave the cold weather to try their hand at gigging flounder.

The Texas Parks and Wildlife Department has implemented management measures, such as a ban on gigging during the month of November and a stock-enhancement program, to promote recovery of the stocks.

Over the past several years, however, southern flounder populations have declined in Texas waters, leading to questions about the sustainability of this important fishery. The Texas Parks and Wildlife Department has implemented management measures, such as a ban on gigging during the month of November and a stock-enhancement program, to promote recovery of the stocks.

Research in the northern Gulf of Mexico and in North Carolina has shown that juvenile southern flounder spend a lot of time in freshwater habitats. It is unclear, however, whether southern flounder in Texas exhibit the same behavior. At the Fisheries and Mariculture Laboratory of the University of Texas Marine Science Institute in Port Aransas, Dr. Benjamin Walther and I conducted a study to determine whether juvenile southern flounder in Texas use freshwater habitats. It is especially important to understand habitat requirements of juvenile fish because these young stages are a particularly vulnerable period in a fish's life cycle.

So, how is it possible to retrace the steps of an individual southern flounder? The answer lies in otoliths, sometimes called "ear stones." These are calcified structures located in the inner ears of fish. Otoliths aid in hearing and balance but can also reveal the fish's age, growth rate, where it was hatched, and its lifetime migration patterns. Much like the rings formed in tree trunks, otoliths grow continuously throughout a fish's life, incorporating naturally occurring trace elements from the surrounding water as they grow. Since the chemical composition

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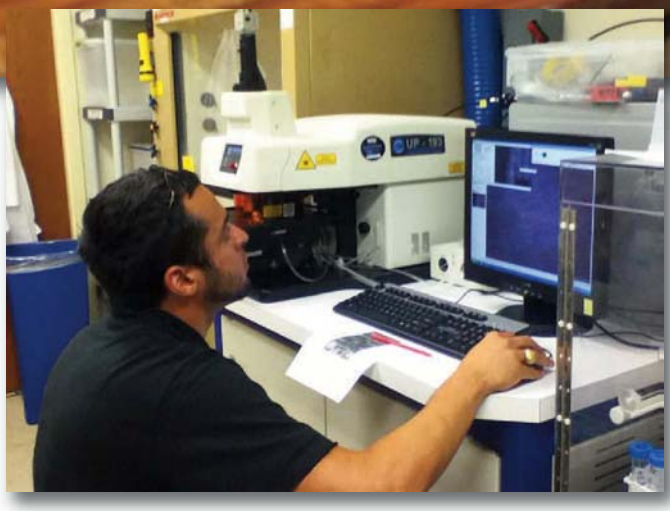

of water varies from place to place, we can match the "chemical signature" of a particular water body to the chemical makeup of the otolith to determine where the fish traveled during its entire life.

To reveal movements of flounder into and out of freshwater habitats, we measured concentrations of the trace element barium in the otoliths. Barium concentrations are generally high in fresh water and comparatively low in sea water. Therefore, if barium concentrations in part of an otolith are high, we can conclude that the fish resided in fresh water at the time that part of the otolith was formed. We analyze barium using a computer-controlled laser system. First, we select the path for the laser to take across the otolith. As the laser moves across the otolith, it blasts off tiny pieces of material from the otolith. These pieces are carried to an instrument that measures the concentration of barium and other chemical elements.

With the help of local fishermen, we collected otoliths from more than 250 juvenile and adult southern flounder, and these otoliths revealed interesting insight into the migration patterns of southern flounder in Texas. We found that, on average, individual fish spent 15 percent of their first year of life in fresh water. Some individuals, however, spent most of their time in fresh water. During their first year of life, 55 percent of the fish never entered fresh water at all, while the remaining 45 percent entered fresh water at least once. Taking their entire lifetime into consideration, 59 percent of the flounder used fresh water at some point.

Of those individuals that did enter freshwater habitats, there were many different migration patterns. Some individuals made one quick trip into fresh water, while other individuals stayed there for a while. Some individuals entered fresh water, then moved back into the bay or estuary, before returning to fresh water a second or even third time. Some individuals moved into fresh water quickly after hatching, while others spent time in the bays and estuaries before moving into fresh water.

The main message we found is that not all flounder are doing the same thing when it comes to using freshwater habitats. There were two distinct

patterns: fish that enter fresh water and those that do not. Beyond that, there is a great deal of variability in when, how often, and how long they use freshwater habitats. Therefore, southern flounder in Texas appear to behave differently from southern flounder in North Carolina and the northern Gulf of Mexico.

These findings are important for managing and conserving southern flounder populations in Texas. Since the majority of the individuals examined in this study used freshwater habitats at some point in their lives, maintaining these freshwater habitats may be critical for the health of southern flounder populations in Texas.

Megan K. Nims earned her B.A. in Evolution & Ecology with a minor in Natural Resource Management from the Ohio State University in 2009 and recently completed her M.S. in Marine Science in 2012 at the University of Texas Marine Science Institute (UTMSI). During her time at UTMSI, Megan was partially supported by the Allen Jacoby Memorial Scholarship, given by the Coastal Conservation Association of Texas.